An analysis of the cost of the abatement of ammonia emissions in Irish Agriculture to 2030

Dominika Krol[1], Cathal Buckley[2] and Maxwell Y. Owusu-Twum[1]

[1]Teagasc, Environment Research Centre, Johnstown Castle, Co. Wexford; [2]Teagasc, Mellows Campus, Athenry, Co. Galway

Summary

- Agriculture is responsible for almost all national ammonia emissions in Ireland
- The European Union (EU) National Emissions Ceiling Directive (NECD) sets emission reduction target for its member states relative to ammonia and other pollutant gases and the Republic of Ireland has exceeded targets over the last number of years.
- This paper outlines the most cost effective pathways to meet future ammonia emission reduction targets as mandated by the EU NECD.
- Results indicated that the adoption of low emission slurry spreading technologies for bovine slurry and the uptake of protected urea chemical fertilisers provided the majority (80%) of ammonia abatement potential.

Introduction

Ammonia is an air pollutant, which has adverse impacts on the environment and public health. Ammonia contributes to ecosystem acidification which endangers the survival of sensitive habitats. Additionally, ammonia plays a critical role in the creation of fine particulate matter, which poses a severe threat to human health and also represents a loss of nitrogen that could be utilised in agricultural systems. In the Republic of Ireland, the agricultural sector accounts for over 99% of national ammonia emissions and the country is currently in breach of its emission targets under the European Union's National Emissions Ceiling Directive (NECD). Reducing ammonia emissions is critical, both in terms of complying with the NECD and as a primary loss pathway for agricultural nitrogen. Improving nitrogen efficiency is a key focus for enhancing farm efficiency and sustainability while also reducing the ammonia, nitrate and greenhouse gas footprint of agriculture. Although numerous management practices exist to reduce ammonia emissions, their applicability and acceptability vary to a great extent at the farm system scale. It is unclear which options are most cost-effective for mitigating ammonia emissions. This paper discusses the most cost-effective strategies to achieve future ammonia emission reduction targets as required by the NECD. This analysis evaluates the best available techniques to reduce ammonia emissions based on scientific peer-reviewed research conducted by Teagasc and its national and international research partners, using cost and efficacy criteria.

Results

Compared to a future where no mitigation measures are deployed to address emissions by 2030 the average technical abatement potential was estimated to be approximately 15.26 kt ammonia at a net cost of €10.86 million per annum. The net cost (€10.86 million) is comprised of six measures that are cost negative i.e. Increases profit (€22.21 million) and seven measures that are cost positive i.e. reduced profit (€33.07 million). Some of the cost negative measures are predicated on efficiency gains driven by best management practice adoption (e.g. liming and clover measures with associated chemical nitrogen reductions). Amongst the thirteen mitigation measures selected for this analysis, 80% of the mitigation potential can be achieved by the full implementation of the mitigation pathways for protected urea (urea with urease inhibitor such as N-(n-butyl)-thiophosphoric triamide (NBPT)) and low emission slurry spreading (LESS) techniques for bovines.

Protected urea reduces ammonia emissions by releasing nitrogen into the soil more slowly than conventional urea fertilisers. This consequently improves the efficiency of the fertiliser by increasing the amount of nitrogen available for plant uptake which results in higher yields. Low emission slurry spreading techniques such as dribble bar, band spreading, trailing shoe or trailing hose apply the slurry in bands or lines directly onto the soil. This reduces the surface area of slurry in contact with air and consequently reduces ammonia emissions. Dribble bar is expected to deliver up to a 30% reduction, trailing shoe a 60% reduction and injection up to a 70% reduction in ammonia loss.

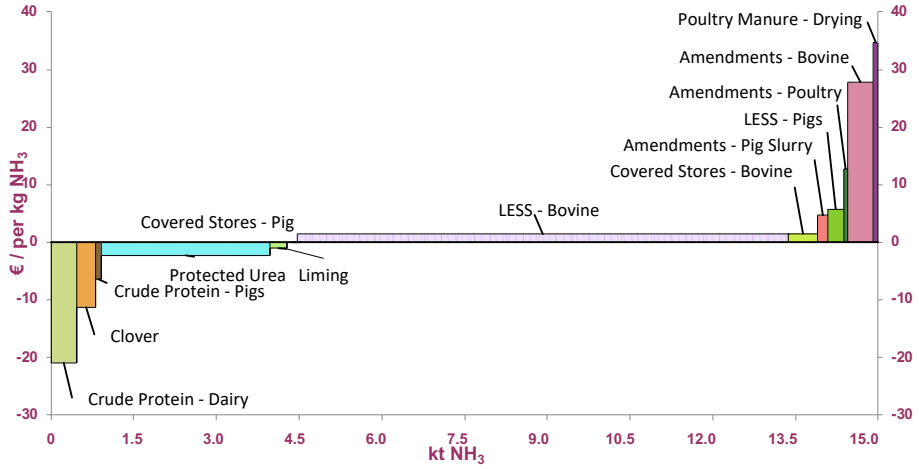

Figure 1. *Ammonia marginal abatement cost curve graph*

Conclusions

Out of the thirteen mitigation measures analysed, 80% of the mitigation potential can be obtained by implementing the mitigation pathways for protected urea and low emission slurry spreading techniques for bovines. In addition, it is estimated that full implementation of the mitigation measures examined will allow Ireland to abate appreciable amount of ammonia to comply with the EU NECD limits under the business as usual scenario. However, it is important to note that achieving the maximum abatement potential will be highly challenging in practice. Any increase in agricultural activity beyond the baseline scenario will increase absolute emissions and additional abatement strategies will be required.